CHAPTER 10 COST ESTIMATES

Cost estimates were created for the transmission line and accompanying transmission stations for the necessary improvements expected for four scenarios. These four scenarios are being estimated in case the full subscription for power needs along the path is not realized. The MW rating for the projects were 450MW for the 230kV option, 650MW for the 345kV option, and 875MW for the 500kV option (AC and DC). Station equipment was sized accordingly.

Cost estimates were based on labor rates escalated to 2008 levels and a contingency of 20% for the projects is used.

Cost estimating techniques involved the use of POWER's historical data bases, vendor quotes, and contractor discussions. Detailed cost estimates are included in Appendix G and H.

10.1 MILL CREEK-BORAH 230kV PROJECT

This project involves the construction of approximately 270 miles of transmission line between Northwest Energy's existing Mill Creek Substation and Idaho Power's Borah Substation. Both substations have existing 230kV bus available to add to. Series compensation was assumed to be required at Mill Creek and a central location on the line near the small town of Lima Montana.

The major equipment components for the project are as follows:

Borah Substation - Terminal Structure, 3 Circuit Breakers, Shunt Reactor

New Lima Compensation Station – Series Capacitor and Station

Mill Creek Substation - Terminal, 9 Circuit Breakers, Phase Shifting Transformer, Shunt Reactor, Series Capacitor

Transmission Line – Double Bundled 1272kcmil ACSR "Bittern" conductor, Tubular Steel H-frame structures

Total estimated project costs are:

Borah Substation -	$4,586,000
New Lima Compensation Station –	$11,371,000
Mill Creek Substation -	$27,051,000
Mill Creek-Borah Transmission Line –	$169,324,000 ($632,000/mile)
Total	**$212,332,000**

10.2 TOWNSEND-BORAH 345kV PROJECT

This project involves the construction of approximately 305 miles of transmission line between a new substation at near Townsend, Montana and Idaho Power's Borah Substation. The Borah substation has 345kV bus available to add to. The new Townsend substation will cut the existing

Colstrip 500kV lines creating four terminal points for the in and configuration. Series compensation is required at Townsend and a central location on the line near the small town of Dubois, Idaho.

The major equipment components for the project are as follows:

Borah Substation - Terminal Structure, 2 Circuit Breakers, Shunt Reactor

New Dubois Compensation Station – Series Capacitor and Station

Townsend Substation - 5 Terminal Structures, 5 500kV Circuit Breakers, 345kV Circuit Breaker, 4 Single Phase 345/500kV Transformers, Shunt Reactor, Series Capacitor, Phase Shifting Transformer

Transmission Line – Double Bundled 1272kcmil ACSR "Bittern" conductor, Self-Supporting Lattice Towers

Total estimated project costs are:

Borah Substation -	$7,397,000
New Dubois Compensation Station –	$15,685,000
New Townsend Substation -	$64,324,000
Townsend-Borah Transmission Line –	$290,673,000 ($962,500/mile)
Total	**$378,079,000**

10.3 TOWNSEND-BORAH 500kV PROJECT

This project involves the construction of approximately 305 miles of transmission line between a new substation near Townsend, Montana and Idaho Power's Borah Substation. Borah Substation will require a new 500kV addition to the station yard. This is assumed to be constructed by Idaho Power independent of this project. The new Townsend substation will cut the existing Colstrip 500kV lines creating four terminals for the in and out configuration.

The major equipment components for the project are as follows:

Borah Substation - Terminal Structure, 3 Circuit Breakers, Shunt Reactor

Townsend Substation - 5 Terminal Structures, 6 500kV Circuit Breakers, Phase Shifting Transformer , Shunt Reactor, Series Capacitor

New Dubois Compensation Station – Series Capacitor and Station

Transmission Line – Triple Bundled 1590kcmil ACSR "Lapwing" conductor, Self-Supporting Lattice Towers

Total estimated project costs are:

Borah Substation -	$11,090,000
New Dubois Compensation Station -	$22,273,000
New Townsend Substation -	$62,378,000
Townsend-Borah Transmission Line –	$418,934,000 ($1,387,200/mile)
Total	**$514,675,000**

10.4 TOWNSEND-MIDPOINT 500kV DC PROJECT

This project involves the construction of approximately 390 miles of transmission line between a new substation near Townsend, Montana and Idaho Power's Midpoint Substation. The Midpoint substation will require additions to the existing 500kV yard as well as a new converter station for the DC line. The new Townsend substation will cut the existing Colstrip 500kV lines creating four terminals for the in and out configuration and the converter station addition.

The major equipment components for the project are as follows:

Borah Substation - Terminal Structure, 3 Circuit Breakers, DC Conversion Station

Townsend Substation - 5 Terminal Structure, 6 500kV Circuit Breakers, DC Conversion Station

Transmission Line – Triple Bundled 1590kcmil ACSR "Lapwing" conductor – 2 Poles, Self-Supporting Lattice Towers

Total estimated project costs are:

Midpoint Substation -	$10,098,000
New Townsend Substation -	$35,579,000
DC Converters	$200,000,000
Townsend-Midpoint Transmission Line –	$465,815,000 ($1,194,400/mile)
Total	**$711,492,000**

10.5 COST SENSITIVITY

Line and station costs sensitivity are driven by material and labor variations. Historically, these factors have been relatively stable. This is not the case in the last five years. Appendix J shows historical commodities costs for aluminum and steel. As shown, these materials have increased in price drastically. According to vendors of these materials, these costs are driven by overseas pressure, in particular China and India, where significant modernization is creating a need for the materials.

Material - Aluminum and steel structures and conductor make up approximately 40% of the line project cost and 60% of the station costs. Current cost estimate assumptions for these materials are. A 20% increase in steel price would increase the project cost by

approximately 5.1% while the same percentage increase in aluminum would increase project costs 3.3%.

Copper, zinc, and cement are all lesser used commodities that have seen dramatic price increases in recent years as well. Although not as significant in terms of project cost, these items may also create upward pressure on total costs.

Labor – Labor is a part of line projects that has also seen significant upward price pressure. A typically 5-10% annual increase in contracting bids might be expected for construction projects and has generally been the case. However, the number of qualified contractors for high voltage construction has dipped due to inactivity in recent years and expertise retirement. If a project of this magnitude was performed as an Engineering, Procure, Construct (EPC) contract, there are likely only three major line contractors large enough to perform and bid the work. After that, smaller players would have to team up and/or secure financing through larger non-construction entities. This last step drives costs up. With the likelihood of several significant 500kV projects being constructed over the next ten years, the labor cost will be driven primarily by the order that a project is bid. The projects taken on by the large high line contractors will receive the best pricing, and costs can be expected to rise the more demand on construction forces is up, i.e. the more projects that are being performed.

A 20% increase in construction cost would increase project cost approximately 9%. Most of this is driven by the transmission line where approximately 50-60% of the line cost is labor and construction equipment cost. As such, the transmission line construction contract is the single most important aspect of the project.

Most recent high voltage transmission line projects have been EPC (Engineer, Procure, Construct) contracts. These contracts place the total responsibility and risk on the Contracting entity. As such, they are generally performed on time. However, the risk of these projects requires the contractors to increase their bids to account for such. If an owner is willing to assume some of the risk for the project, a significant savings is possible. This risk can be reduced with excellent project management.

10.6 COST ALTERNATIVE

Guyed Tower Design - For the transmission line costs, a self-supporting tower option was assumed. An alternative was considered whereby guyed towers were assumed. The structural costs were discussed earlier in the report. For the Townsend-Midpoint project, it was assumed that 25% of the line could be constructed with the guyed tower design. This assumption is due to geographic factors. In extremely steep terrain, it will be difficult to find a place to guy reasonably and the right of way impact could be significant. In the southern portion of the project, the presence of lava rock will dictate much of the design. It was assumed that anchoring into rock would likely be more expensive than foundations used for self-supporting towers. The guyed tower alternative impacts project price by approximately 5%.

Series Compensation – For the 500kV line, series compensation is not required for the stated flow of 875MW. According to the electrical models, the flow was not improved with compensation. The models were also run with flows of 1200MW and 1600MW respectively. With these flows, the installation of series compensation at one location (1200MW) and two locations (1600MW) is necessary. These compensation additions are estimated at $15 million apiece.